A BRONCHIOLITIS STUDY: THE OVERUSE OF BRONCHIOLITIS THERAPIES IN CHILDREN ADMITTED INTO THE HOSPITAL

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2018

COLUMBUS STATE UNIVERSITY

A BRONCHIOLITIS STUDY: THE OVERUSE OF BRONCHIOLITIS THERAPIES IN CHILDREN ADMITTED INTO THE HOSPITAL

A THESIS SUBMITTED TO THE

HONORS COLLEGE

IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR HONORS IN THE DEGREE OF

BACHELOR OF SCIENCE

DEPARTMENT OF BIOLOGY

COLLEGE OF LETTERS AND SCIENCES

BY

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ABSTRACT

Bronchiolitis is prevalent among infants of 0 to 12 months, and usually caused by a variation of viruses. Signs and symptoms consist of coughing, rapid breathing, and an occasional fever in some infants. Bronchiolitis is not treated with antibiotics, but rather with proper medical examination and other procedures. Chest radiographs, steroids, and certain bronchodilators are considered ineffective treatments. This study indentified the amount of ineffective procedures being used in infants admitted into the pediatric emergency room, and the effect it had on the patient's average hospital stay. Past medical records were used in this clinical study. Statistical analyses and graphs depicted the results of ineffective procedures causing about an hour of difference in hospital stay for the patient, as well as a low amount of effective procedures in the patient visits. Parent pressure, insufficient data on the condition, or the hospital's routine procedure could have affected the results.

INDEX WORDS: bronchiolitis, respiratory syncytial virus, procedure, infant

ACKNOWLEDGEMENTS

I would like to thank my thesis advisor and committee member for helping me throughout my internship because without them, I would not have accomplished what I did. Another thank you is extended to my off-campus thesis advisor, Dr. Rebecca Reamy, and her assistant, Mrs. Lea Cunningham, for the wonderful assistance at Midtown Medical Center (or Piedmont Columbus Regional). Thank you to the Honors College staff and faculty, family, and friends for the constant support throughout the process. This thesis is dedicated to everyone that helped me along the process.

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INTRODUCTION

Throughout the course of this internship, I gathered data from past patient records at Midtown Medical Center. Midtown Medical Center is located in Columbus, Georgia, and is categorized as a private, non-profit healthcare organization or hospital (Columbus Regional Health, 2016). It provides a variety of services, such as a pediatric intensive care unit (PICU), neonatal intensive care unit (NICU), pediatric emergency department, and a trauma center. The pediatric services offered by Midtown Medical Center strive to relieve the suffering of a child. About 1-2% of children between 0 to 12 months of age are commonly hospitalized for bronchiolitis (Worrall, 2012). There is no cure for bronchiolitis solely because a virus commonly causes it (Maraqa, 2016). Nevertheless, the pediatricians and nurses at Midtown Medical Center strive to effectively treat the infection.

Bronchiolitis is an acute lower respiratory tract infection in infants of 0 to 12 months of age. The most common cause of bronchiolitis is the respiratory syncytial virus (RSV), which is an enclosed, negative-stranded RNA virus, and it begins with its replication in the nasopharynx, which then spreads to the bronchiolar epithelium lining the small airways of the lungs according to Dawson-Caswell and Muncie from Louisiana State University (2011). The respiratory infection can occur rather rapidly, and it can occur during the winter and spring months of the year, including October to May (Ralston et al., 2014). Nevertheless, it can also occur in other parts of the year, but not as often.

Bronchiolitis is clinically diagnosed when the infant is presenting signs and symptoms of rhinitis or coughing leading to wheezing, crackling, and/or tachypnea that can also lead to labored breathing and/or difficulty in the intake of food and/or fluids (Settin, n.d.). In addition to those signs and symptoms, an occasional fever can also be present in patients with bronchiolitis

(Mayo Clinic Staff, 2018). According to the American Academy of Pediatrics (AAP), the severity of the infection should be assessed after the physician takes the patient's medical history, a complete physical exam including vital signs and pulse oximetry, and evaluates the patient's hydration status (Ralston et al., 2012). Instead of the alternative methods, AAP recommends that the physician should take the history of apnea, rate of respiration, mental status, breathing distress, oxygen saturation, and the ability to take in food and fluids into consideration when determining whether the patient requires more medical attention (Ralston et al., 2012). If the patient is diagnosed with bronchiolitis, the physician may ease the symptoms by administering oxygen to the infant to maintain oxygen saturation >90%, nasal suctioning if obstruction is present, and by maintaining hydration through intravenous therapy (IV) or nasogastric feedings (Ralston et al., 2012). These therapies are thought of first before proceeding onto other therapies, such as nebulized epinephrine, which is used only if the infant does not seem to be improving. If the treatment seems ineffective, the infant will be admitted into the hospital and observed until he or she is stable or improving in health. However, if the infant does seem to be improving, the child can be discharged from the hospital, if they meet certain criteria. The criteria standards are oxygen saturation >90%, mild to moderate respiratory work, stable hydration level, and following up with the physician (Ralston et al., 2012). This process of diagnosing bronchiolitis is a clinical algorithm put together by AAP.

AAP Section on Emergency Medicine Committee on Quality Transformation
Clinical Algorithm for Bronchiolitis in the Emergency Department Setting

Bronchiolitis Content Expert Team
Shabnam Jain, MD | Champion: Children's Healthcare of Atlanta
Anne Stack, MD | Co-Champion: Boston Children's Hospital
Marc Baskin, MD: Boston Children's Hospital
Laura Chapman, MD: Hasbro Children's Hospital
Peter Dayan, MD: Morgan Stanley Children's Hospital
Mark Meredith, MD: Le Bonheur Children's Hospital
Graham Thompson, MD: Alberta Children's Hospital
Joseph Zorc, MD: Children's Hospital of Philadelphia

Note
This algorithm does not represent AAP policy and was not reviewed or approved by the AAP Board of Directors.

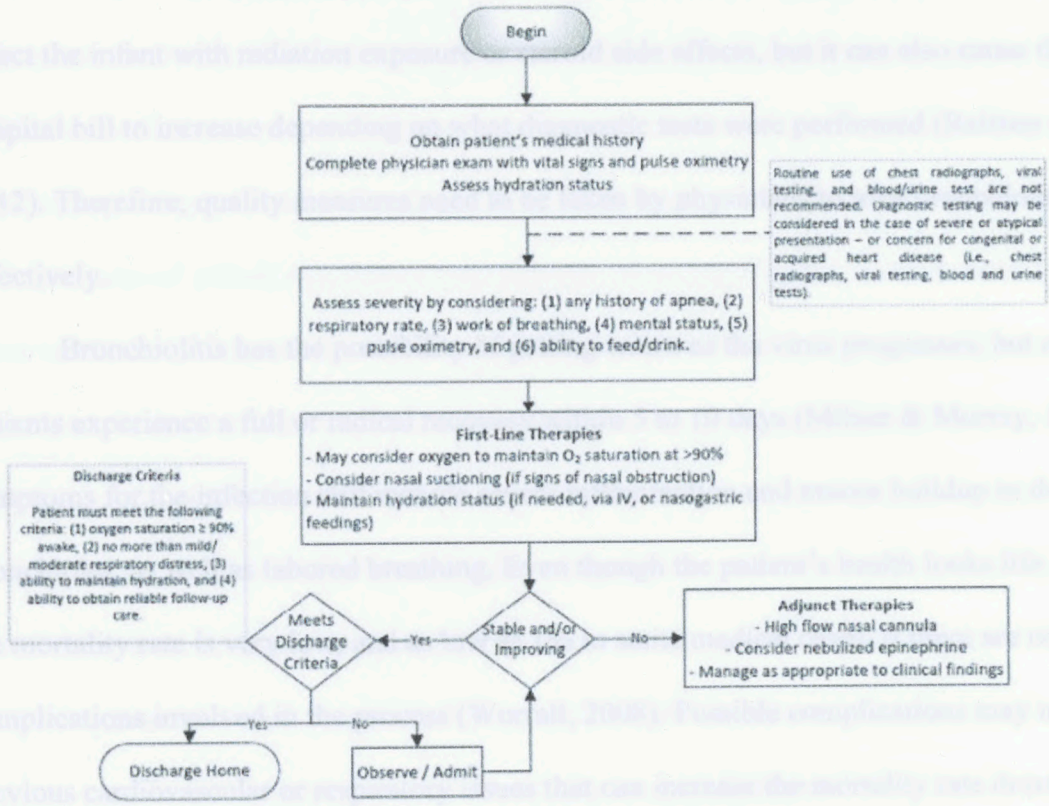
Overview
The American Academy of Pediatrics (AAP) Section on Emergency Medicine (SOEM) bronchiolitis algorithm is designed as an easy-to-follow tool to help clinicians care for infants with bronchiolitis in the acute care setting. This algorithm incorporates AAP recommendations for bronchiolitis with the goal of limiting unnecessary testing and therapies in this self-limited illness, while also mentioning newer therapies that sometimes need to be considered in severe and/or undifferentiated presentation in the emergency department (ED). The algorithm also assists the practitioner with disposition from the ED.

Reference Material – AAP Bronchiolitis Guideline
http://pediatrics.aappublications.org/content/134/5/e1474

Scope Does not apply if severe or atypical presentation.

Inclusion Criteria Children, 1-12 months of age, presenting with symptoms and signs suggestive of a clinical diagnosis of bronchiolitis, such as upper respiratory tract infection such as rhinitis and coughing, progressing to lower respiratory symptoms including wheezing, crackles, and/or tachypnea that may result in difficulty breathing and/or difficulty feeding.

Exclusion Criteria Full-term infants that are less than 28 days old or premature infants that are less than 48 weeks post-conception. Patients with hemodynamically significant cardiac or significant pulmonary disease (such as bronchopulmonary dysplasia or asthma) or other major chronic conditions (such as immunodeficiency and neuromuscular disease).



Disclaimer: This algorithm was developed through the efforts of the American Academy of Pediatrics Section on Emergency Medicine in the interest of advancing pediatric healthcare. It does not represent AAP policy nor is it a professional care standard governing providers' obligation to patients. Ultimately, the patient's physician must determine the most appropriate care.

FIGURE 1. American Academy of Pediatrics algorithm for bronchiolitis treatment.

Studies have shown that the use and overuse of other therapies, such as albuterol, steroids, chest radiography, and viral testing can have a greater negative or neutral impact on the infant rather than a beneficial effect. For instance, Center for Disease Control has found that that one in four infants actually has a response when albuterol is administered to them (2016). The other three in four infants showed no response to the treatment. Therefore, albuterol is not usually recommended for bronchiolitis treatment, even though it is used for asthma treatment. The correlation between asthma and bronchiolitis is another study all within itself and has been looked at since 1959 by Witting and Glaser (Mansbach & Camargo, 2009). Nonetheless, the use of steroids, chest radiographs, and viral testing are often times overused by physicians in despite of no evidence backing up this utilization. These ineffective therapies or treatments can not only affect the infant with radiation exposure or steroid side effects, but it can also cause the patient's hospital bill to increase depending on what diagnostic tests were performed (Ralston et al., 2012). Therefore, quality measures need to be taken by physicians to treat bronchiolitis most effectively.

Bronchiolitis has the possibility of getting worse as the virus progresses, but most patients experience a full or radical recovery within 5 to 10 days (Milner & Murray, 1989). The symptoms for the infection still include severe inflammation and mucus buildup in the bronchioles, as well as labored breathing. Even though the patient's health looks life threatening, the mortality rate is very low, and as low as 1% in some medical cases, if there are no complications involved in the process (Worrall, 2008). Possible complications may include previous cardiovascular or respiratory issues that can increase the mortality rate drastically. However, the possibility of the patient recuperating from the virus and its effects are extremely high.

Many studies have been done in regards to bronchiolitis and its most effective treatment. However, they are done on a large scale where individual hospitals do not see their respective statistics and effects on their patients. Thus, this study was similar to that of Ralston and his colleagues, but at a smaller scale, in order to make a bigger impact on a hospital. The effect of this study lied in helping physicians notice the impact of their decisions on a child's health and how often the overuse of therapies are utilized.

Various factors went into this study to eliminate as many variables as possible. For instance, the patients were chosen based off of past medical records and whether they were diagnosed with bronchiolitis at Midtown Medical Center. The study assessed how many infants were being given excess therapies or treatments in relation to how many were given the appropriate recommended treatments. In order to determine if excess treatment was given to the child, the medical record had to display that the child received steroids, chest radiographs, or viral testing at any point after the diagnosis of bronchiolitis. The expectation of this study was to make the ratio of infants still treated with steroids, chest radiography, and viral testing to the amount of infants diagnosed with bronchiolitis in Midtown Medical Center evident to the physicians. I expected the study's ratio of patients being given unnecessary treatments to be around 30-45% of the entire sample taken from the hospital records. This percentage came from closely looking at other studies conducted at a larger scale and their results. I worked closely with Dr. Rebecca Reamy, the Chief of Pediatrics at Midtown Medical Center, as well as other medical technicians, staff, nurses, or doctors that assisted. I collaborated with Dr. Kathleen Hughes, a professor at Columbus State University, in an effort to make this research reproducible for future reference. This internship only helped Midtown Medical Center see their statistics in this area of research, but it also gave me more knowledge in the area of pediatrics. Studying

bronchiolitis is a topic that will help me in my efforts in becoming a pediatrician in the near future.

MATERIALS AND METHODS

Patient Selection:

Past patient medical records used for this collection of data. The infants that were chosen needed to have been diagnosed with bronchiolitis, no prior respiratory or heart health issues, and be within 0 to 12 months of age. No biases were made for male or female infants in the study.

Data Collection:

The medical records obtained either through Meditech or through another program that was provided by Midtown Medical Center, under the supervision of Dr. Reamy. The years observed were from 2012 to 2017. All confidential information regarding the patient's name and personal information was kept confidential. However, I collected what treatment was given to the patient, how much of that treatment in terms of dosage, and how often it was given. Gender and age of the child were be a limiting factor when acquiring data from medical records as long as the child was within the age of 0-12 months of age. Complications, such as heart or respiratory issues, with the child before being diagnosed with bronchiolitis eliminated that medical record from being included in the study because the path onto which the child received treatment could have been altered for those history purposes. Furthermore, if the child was allergic to one of the pathway options in the AAP algorithm, then that child also was not be included in the study, since the treatment would have been different. A random sample of approximately 400 infants was taken. An excel sheet with no personal information was used to collect the data, in order to see what treatment the patients received. This period lasted approximately from August 2017 to

December 2017. Then, a statistical analysis over the data collected was conducted. Nonetheless, IRB approval was a prerequisite for conducting this study.

DATA ANALYSIS

After the data was collected, the null hypothesis of therapy usage on the child not having an effect on the child's recovery was analyzed through an independent t-test. The independent t-test is a statistical analysis method that compared the averages of two independent groups to determine if the means were statistically different. The two variables observed were the type of treatment(s) and the qualitative improvement of the child's recovery. From the t-test, a p-value was obtained to conclude whether to accept or reject the null hypothesis. The null hypothesis would be rejected if the p-value from the t-test was below 0.05, and the alternative hypothesis of therapy usage on the child having an impact on the qualitative improvement of bronchiolitis recovery would be accepted. The sample size consisted of approximately 400 patient visits. Then, the total amount of patients that received steroids, viral testing, or chest radiographs was added up and put onto a bar graph. This would give the physicians a perspective in how often an overuse of therapies was used to treat children with a diagnosis of bronchiolitis. Some cases may have the possibility of having a combination of therapies in which case, the procedure or therapy was only counted per visit rather than per use. All bar graphs were used to enhance the understanding of the results in the experiment.

RESULTS

Out of the 353 patient visits used in the study, 116 visits followed an effective procedure, while 237 did not completely administer proper procedures in the patient visit (Fig. 2). Procedures, such as communication nursing, airway suctioning, and pulse oximetry, were each incorporated in less than 100 visits for treatment (Fig. 3). Chest radiographs, different forms of

albuterol and steroids, and other ineffective procedures exceeded that of the procedures recommended by AAP (Fig. 3). Furthermore, the use of ineffective procedures impacted the average length of stay by being 2.45 hours (+/-1 S.E.), while the use of proper procedures had a mean of 1.67 hours (+/-1 S.E.) (Fig. 4). The average length of stay at the hospital was about an hour difference with the type of procedure administered to the patient. A significant difference was seen when comparing the average length of stay in the hospital to whether an effective procedure was administered to the patient ($p=2.22x10^{-9}$). These results suggest that the overuse of ineffective procedure does have an effect on the length of stay of the patient. Many causes could have led to the results seen in this study.

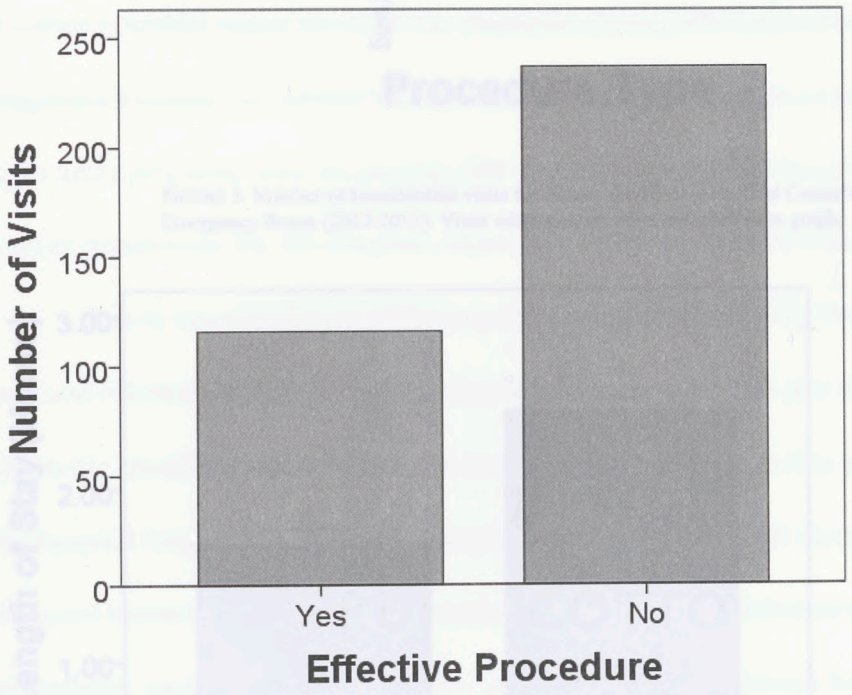


FIGURE 2. Number of bronchiolitis visits for infants at Midtown Medical Center's Emergency Room (2012-2017). Visits with complications excluded from graph.

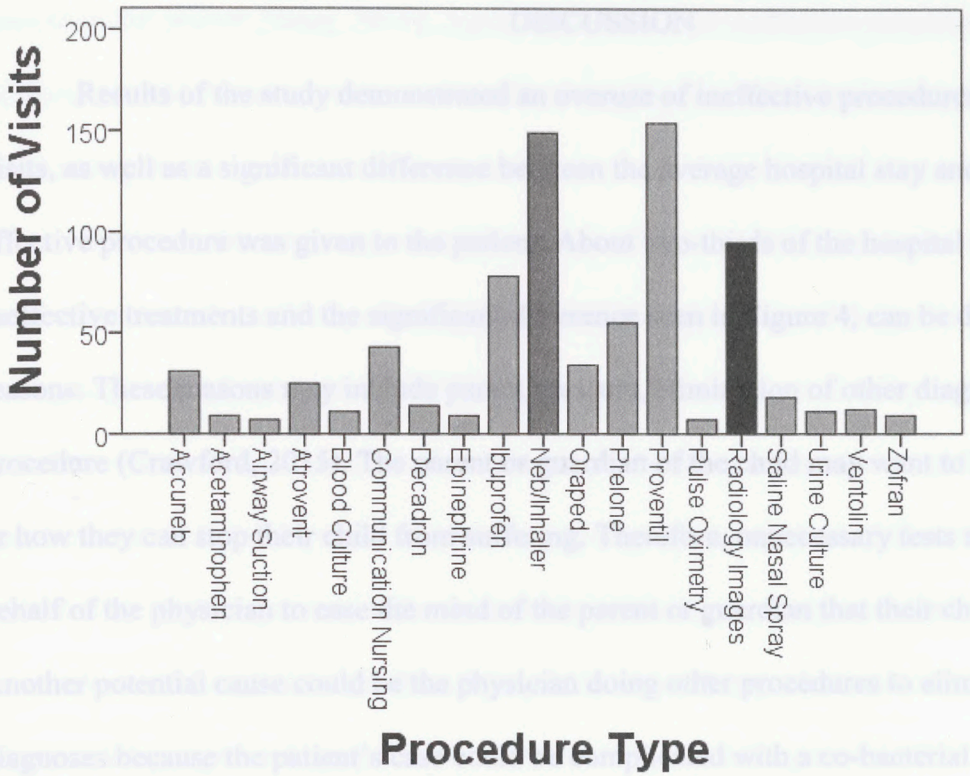


FIGURE 3. Number of bronchiolitis visits for infants at Midtown Medical Center's Emergency Room (2012-2017). Visits with complications excluded from graph.

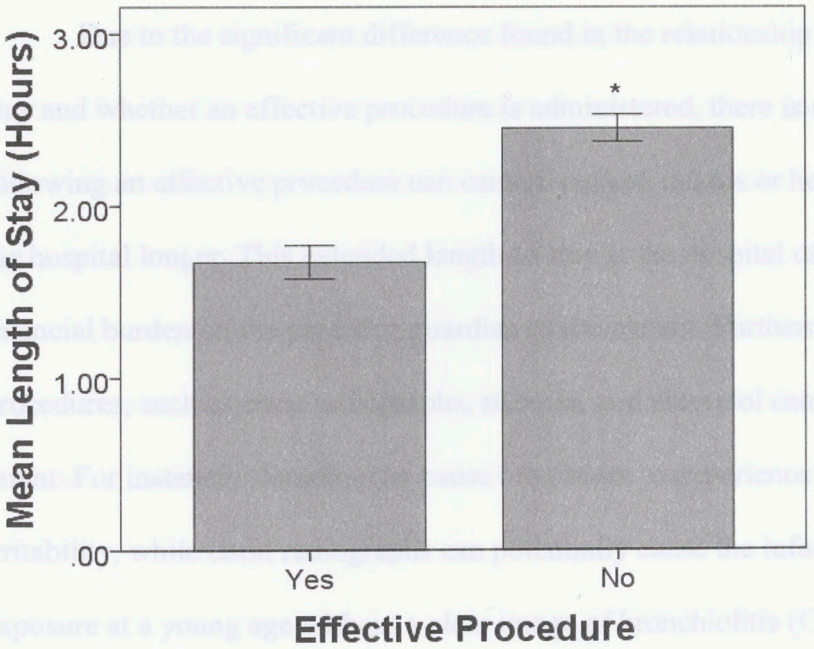


FIGURE 4. Average length of stay (+/-1 S.E.) for infants at Midtown Medical Center's Emergency Room (2012-2017) in hours. Visits with complications excluded from graph. Bars labelled with p value less than 0.05.

DISCUSSION

Results of the study demonstrated an overuse of ineffective procedures in most patient visits, as well as a significant difference between the average hospital stay and whether an effective procedure was given to the patient. About two-thirds of the hospital visits receiving ineffective treatments and the significant difference seen in Figure 4, can be due to a few reasons. These reasons may include parent pressure, elimination of other diagnoses, and routine procedure (Crawford, 2015). The parent or guardian of the child may want to know how to help or how they can stop their child from suffering. Therefore, unnecessary tests may be done on behalf of the physician to ease the mind of the parent or guardian that their child will be fine. Another potential cause could be the physician doing other procedures to eliminate other diagnoses because the patient's case could be complicated with a co-bacterial infection or the signs and symptoms may be unusual. On the contrary, ineffective procedures could also be routine procedures for the hospital, especially in the emergency room.

Due to the significant difference found in the relationship between the average length of stay and whether an effective procedure is administered, there is a strong indication that not following an effective procedure can cause a patient and his or her parent or guardian to stay at the hospital longer. This extended length of stay at the hospital can potentially increase the financial burden on the parent or guardian of the patient. Furthermore, the usage of other procedures, such as chest radiographs, steroids, and albuterol can have negative effects on the infant. For instance, albuterol can cause the patient to experience tachypnea, hypoxia, and irritability, while chest radiographs can potentially cause the infant to experience radiation exposure at a young age without a clear image of bronchiolitis (Crawford, 2015). Steroids have also been shown to be ineffective for bronchiolitis treatment, and it has a side effect of stunting

growth in the patient (Bajaj, 2011). Again, the overuse of ineffective procedures can be the result of many possible causes, and it can be difficult to pinpoint which is a more prevalent cause when just looking at old medical records.

However, there are ways that the overuse of bronchiolitis treatments can be avoided. The main improvement can be by educating the parents or guardians of the patients while in the emergency room (Ralston et al., 2014). Physicians can educate parents by telling the parents or guardians what can be done about the virulent condition, and what are considered an overuse of treatment for their child's case. Another way to improve would be to follow the algorithm endorsed by AAP on patients without severe bronchiolitis and stay up to date with medical innovations. Although the algorithm is helpful in determining what to do when a child is demonstrating signs and symptoms for bronchiolitis, it is not a guarantee that is always the best option for the patient (Ralston et al., 2016). It is ultimately up to the physician to decide what is best for the patient because every visit is different

Studies have been done in the past about bronchiolitis and the overuse of therapies in treating the condition, but this is the first study conducted in a small scale of a single hospital. These results will help other researchers and the public population have more information on the topic, but more research is still needed, such as determining at what point in the patient visit is the unnecessary procedure being ordered or administered. Furthermore, more contemporary studies on a smaller scale need to be conducted and compiled for the purpose of limiting the overuse of ineffective procedures in patients.

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